SPODOPTERA LITURA FAB AND AGERATUM CONYZOIDES LINN OF ASTERACEAE GROWTH INHIBITORY ACTIVITIES AGAINST

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ABSTRACT

In agriculture, plant extracts have provided several advantages. The search for natural products and their counterparts in the crop protection market has been extraordinarily fruitful, particularly in the area of pest control, thanks to global efforts throughout the globe. In this research, two Asteraceae plants are tested for their ability to kill Spodoptera litura, an important pest (Fab.). The developmental period and morphogenesis of S. litura larvae are altered by the chloroform, ethanol, water, and aqueous extracts of these plants. These plants. Ageratum conyzoides and Artemesia vulgaris have the most biological and morphological impacts of any of the two species. Larvae treated with Asteraceae plants had the highest rates of pre-emergence and larval deformity. Juvenile hormone (JH) mimics found in Asteraceae plants interact with the endocrine system, according to this study.

KEYWORDS: Morphogenesis, Ageratum conyzoides, Artemesia vulgaris, and Spodoptera litura

INTRODUCTION

Chemical pesticides used in agricultural insect pest management programs throughout the globe have caused environmental harm, a return of pests and a rise in pest resistance to insecticides while also killing non-target creatures in recent years. Scientists have been driven to look for alternatives to chemical pesticides because of the harmful effects they have on the environment (Abudulai et al., 2001). There are several ways in which botanical pesticides work, making them an excellent alternative to neurotoxins such as organophosphates. Toxicity, antifeedant, and anti-ovipositional effects are a few examples. (Sutherland et al. 2003) Insect herbivory may be limited by antifeeding activity, despite the fact that plant compounds may be poisonous to insects.

Crude extracts of many plant species have been studied for their entomotoxic effects in a number of articles (Tapondiou et al., 2005; Ulrichs et al., 2008; Baskar et al., 2009). New interest in Asteraceae species as a source of plant-derived insecticides has recently been piqued by the finding

that phototoxins contained in certain species have been shown to have insecticide action. An everyday plant, Ageratum conyzoidesMany nations' traditional medicine use this annual herbaceous plant, particularly in tropical and subtropical areas. Alkaloids, cumarins, flavonoids, chromenes, benzofurans, sterols, and terpenoids are just a few of the many substances that have been found in this species. Medicinal and insecticide properties have been discovered in plant extracts and their metabolites (Anjoo Kamboj and Ajay Kumar Saluja, 2008). Environmentalists, ecologists, farmers, and animal scientists are concerned about the fast spread of Ageratum and Artemesia. In contrast, the larvicidal action of weed plants, which may be found in large areas of both plains and hills, has not yet been studied. Big quantities of weed plants spread over a large region render such areas unusable as farmland or cow feed. The mountainous region of Tamil Nadu's Nilgiris district is home to a large number of these invasive plants, which cover large regions.

CONTENTS AND METHODS

Recinus communis L. (Euphorbiaceae) castor was obtained in and around Coimbatore District, Tamil Nadu, India and raised under laboratory conditions (29 1°C temperature; 65 – 70 percent RH and 11L and 13D photoperiods) on castor leaves in plastic containers of 21.0 X 28.0 X 9.0 cm in size. Third and fifth-instar larvae hatched in the laboratory were employed in the tests..

Preparation of Plant Extracts for Use

Nearly 1200 meters above sea level, researchers in Coonoor, Nilgris, Tamil Nadu, gathered aerial portions of Ageratum conyzoides and Artemesia vulgaris for study and analysis. To get a fine powder, dried plant pieces were washed three times with tap water and a fourth time with distilled water before being ground to a powder. Chloroform, ethanol, and water were used to separate 500 grams of powder. Three hundred grams of dried plant powder were lyophilized for eight hours, then stored for twentyfour hours to make the aqueous extract. Filtration was used to create the extract. To generate a 10% stock solution, the crude plant extracts were redissolved in their respective solvents and 5ml of an adjuvant containing 0.05 percent Teepol was added. It was used to make varied amounts of 0.025, 0.05, 0.075, 0.5 and 1.25 % chloroform; ethanol; water; water; aqueous extracts; and aqueous extracts from this stock solution.

Bioassay

The pesticidal activity of plants was evaluated using the leaf dip technique. Using ten grams of castor leaves, the plant extracts were steeped in varied concentrations. Leaves were used as a control, soaking in various solvents and adjuvants. After drying for five minutes, the leaves were fed to the fifth instar larvae for three days in a row (6 hours of starvation). Each experimental category was reproduced six times with a minimum of 10 larvae per concentration. Abbot's formula (Abbot, 1925) was used to mortality data in order to calculate the adjusted percentage of mortality if any mortality was found in the control.

$$\text{Per centage mortality} = \frac{\text{Number of dead larvae}}{\text{Number of larvae introduced}} \times 100$$

$$\text{Corrected per centage mortality} = \left(1 - \frac{\text{Number in T after treatment}}{\text{Number in C after treatment}}\right) \times 100$$

Where, T- experimental category and C – control category.

This method was used to compute the lower fiducial limit, the median lethal concentration (LC50), and the upper fiducial limit (LC90) (Finney, 1971).

Research in Child Development

Fresh castor leaves were used to feed newly moulted larvae until their fourth moulting. Six-hour-starved fifth-instar larvae were weighed and fed leaves treated with a 1:1 dilution of the LC50 concentration of chloroform, ethanol, water, and aqueous extracts of the plants with 0.05 percent Teepol as an adjuvant continuously for 72 hours. 0.05 percent adjuvant was added to the relevant solvent for the control leaves. Freshly treated leaves were used to replace the ones that had been devoured by the larvae (5 replicates, 10 larvae per concentration). They fed the larvae untreated castor leaves that were still in the process of sprouting. The duration of the larval and pupal stages was documented.

The study of statistics

All the data was evaluated using one-way Analysis of Variance (ANOVA) in a totally randomized manner, and the means were separated using Tukey Multiple Range Test (TMRT). Probit analysis was used to compute the LC50 and LC90 values, which were determined using SPSS version 11.5. (Finney, 1971).

RESULTS

The larvae of Spodoptera litura were killed by chloroform, ethanol, water solvent, and aqueous extract of the chosen plant, but there were minor variances across extracts (Figure 1A & B). Toxic amounts of both plants were found in aqueous and chloroform solvent extracts, then in ethanol and aqueous solutions. Figure 1 A shows that A. vulgaris is more poisonous than A. conyzoides, with an LC50 of 0.140 percent at 72 hours for A. vulgaris (Figure 1 A). The LC50 value decreases with increasing exposure time in S. litura third instar larvae, which similarly show a decreasing pattern of sensitivity with increasing exposure hours. Treatment groups treated with ethanol solvent extract had higher death rates than control mice. The larval phase is prolonged in A. vulgaris treated groups. The larval phase of A. conyzoides is extended to its fullest extent by the water solvent extract of this species. Both ethanol and chloroform extracts from A. vulgaris and A. conyzoides were shown to have an extended pupal phase (Figure 2 II A & B). Aquatic extract of A. vulgaris had the greatest percentage of extension. When it comes to four plant solvents, water extracts have the most significant impact on larval development ($F = 1200.054$ [$df = 1$]; $df = 1$; $p=0.000$]; ethanol extracts ($F = 329.83$ [$df = 1$]; $df = 1$; $p=0.0004$]; and chloroform extracts ($F = 46.632$ [$df = 1$]). S. litura's pupal duration was also shown to be statistically significant. (Figure 3, I E, I W and I C) A. conyzoides ethanol extract had the lowest percentage of prepupation, followed by water and chloroform extracts (73.3 0.071 percent and 74.6 0.04 percent, respectively) (Figure 3, I C). Also, the percentage of A. conyzoides ethanol and water (68.0
0.245 percent) that had pupation dropped to 68.0 0.22 percent (Figure 3, II E & W). Aquatic extracts of A. vulgaris significantly decreased

adult Spodoptera litura emergence (61.0 0.11 percent), and aqueous extracts followed suit (64.0 0.2245 percent). In A. conyzoides ethanol (20 0.374 percent) and chloroform (9.3 0.032 percent), the number of malformed adults was greater (Figure 3, V E & C). In this work, no larval or pupal intermediates were found, but significant morphological alterations occurred, such as malformed pupae and deformed adults S. litura were generated. It was A. vulgaris, followed closely by A. conyzoides, that generated the most significant morphological alterations (F= 583.63; df = 4; p = 0.000; p 0.05).

DISCUSSIONS

Polyphagous Spodoptera moths from the noctuid genus Spodoptera cause economic losses in a wide range of agricultural crops across the globe (EIAswad et al., 2003). Resistance to many of the registered pesticides used to combat it has developed as a consequence of the wide range of insecticides used to combat it (Kranthi et al., 2002; Aydin and Gurkan, 2006). For integrated pest control, novel pesticides derived from natural products targeting Spodoptera litura might be a viable option. To explain why ethanol extracts demonstrated higher mortality than water-based extracts, it may be because ethanol contains polar chemicals, whereas water-based extracts include nonpolar molecules. Complex pest control chemicals may benefit from the synergistic effects of natural combinations, according to Audrey and Isman (2004). When isolated in the lab, these plant combinations may exhibit more bioactivity than their individual components, and insect resistance is far less likely to develop when chemicals are mixed together (Chen et al., 1995). (Feng and Isman, 1995; Ateyyat et al., 2009). It is possible that the variance in the active principle of the chosen plants is responsible for the significant mortality found in A. conyzoides (32.03 percent) and A. vulgaris (32.25 percent) solvent extracts of Asteraceae plants (Bouda, 2001; Moreira et al., 2007). According to Pascual and Robleodo (1999), the phytochemical makeup of plants varies with altitude, with higher altitude plants accumulating more flavanoids than lower altitude plants. The disturbance of the endocrine systems governing moulting, which may be caused by disruption in the production and release of growthpromoting ecdysteroids or similar hormones, might boost or reduce larval development. According to previous studies, several plants have been shown to have an effect on the body's hormonal system (Lange et al., 1983; Padmaja and Rao, 1999). The larvae fed with Asteraceae plants also had the highest rates of pupation and larval abnormalities. This supports the hypothesis that Asteraceae plant Juvenile hormone (JH) mimics interfere with the hormonal system (Kamal and Mehra, 1991; Saxena, et al., 1994). The control of molting and metamorphosis is largely dependent on juvenile hormone mimics. A. conyzoides has increased the length of both the larval and pupal stages.

Asteraceae plants have powerful insecticidal effects by interfering with the reproductive cycle by interfering with hormones, which may explain the observations of discoloration, leaking out fluid, softness of the body, and ambiguous segmentation in the treated groups (Onyilagha et al., 2004). According to Larsen et al. (1993), a wide range of activity in Asteraceae plants is to be anticipated due to the wide structural variety of their chemicals. Further research is needed to determine the active chemicals found in these plants in order to develop a viable plant-based biopesticide that is safe for humans and beneficial creatures while posing the least impact to the environment.

CONCLUSIONS

S. litura's developmental time was shortened by the insecticide and growth regulator activities of Artemesia vulgaris and Ageratum conyzoides. Larvae of S. litura were affected by chloroform, ethanol and water extracts of these plants. Further research is needed to determine the active chemicals found in these plants in order to develop a viable plant-based biopesticide that is safe for humans and beneficial creatures while posing the least impact to the environment.

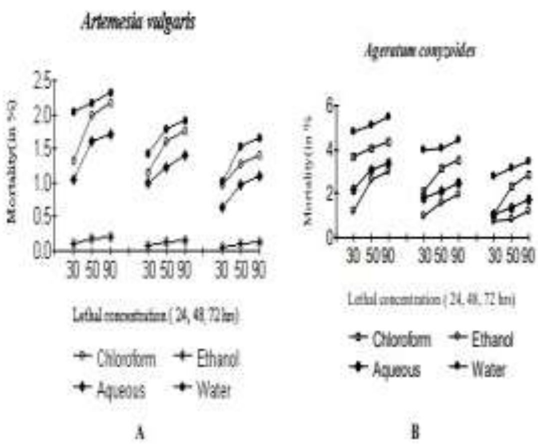


Figure 1: Analytical parameters for probit analysis of selected plant extracts on S. litura third instar larvae at different treatment times

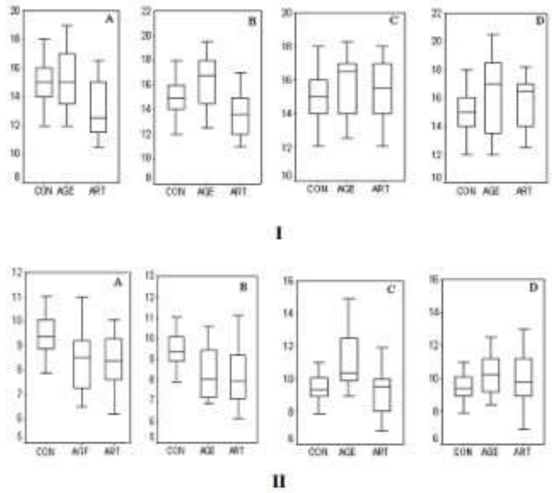
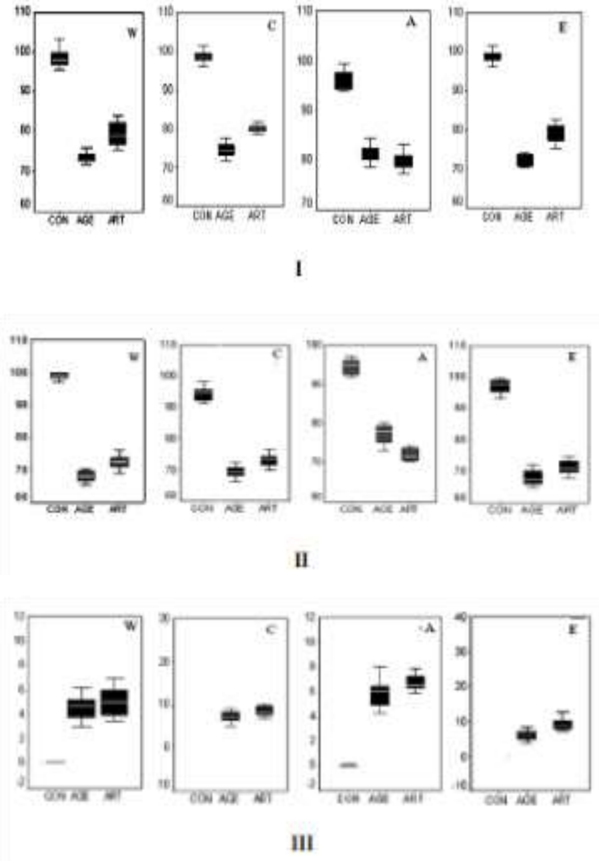


Figure 2Chemicals A, B, C, and D: Biological Effects of Ethanol, Chloroform, Aqueous, and Water (in Days) Control, A. conyzoides, and A. vulgaris extracts on S. litura larval (I) and pupal duration



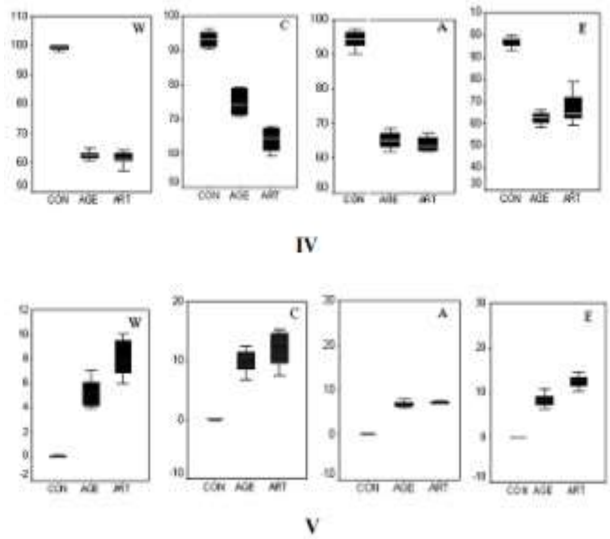


Figure 3***: Selected Plant Extracts' Morphogenetic Effects on S. LituraPrepupation (I), Pupation (II), Deformed Pupae (III), Adult Emergence (IV), and Deformed Adult (V) (in Percent); CON – Control; AGE – A. Conyzoides; ART – A. Vulgaris***

REFERENCES

1.Abbot, W. S. (1925). A method of computing the effectiveness of insecticides. Journal Economic Entomology, 18, 265 – 267.

2. Abudulai B.., Shepard, M. & Mitchell, P. L. (2001). Parasitism and predation on eggs of Leptoglossusphyllopus (L.) (Hemiptera: Coreidae) in cowpea: impact of endosulfan sprays. J. Agr. Urban Entomol., 18, 105-115.

3. Aydin, M. H. &Gurkan. M. O. (2006). The Efficacy of spinosad on different strains of Spodoptera littoralis (Boisduval) (Lepidoptera: Noctuidae). Turk. J. Biol., 30, 5- 9.

4. AnjooKambooj& Ajay Kumar Saluja. (2008). Ageratum conyzoides L.: A review on its phytochemical and pharmacological profile. Bioresource Technology, 89 (2), 213 – 216

5. Ateyyat, M. A., Al-Mazra'awi, M., Abu-Rjai, T. &Shatnawi, M.A. (2009). Aqueous extracts of some medicinal plants are as toxic as Imidacloprid to the sweet potato whitefly, Bemisiatabaci. 6 pp. Journal of Insect Science, 9 (15), 6 p. 6. Audrey, J. L. & Isman, M. B. (2004). Insecticidal activity of crude seed extracts of Annona spp., Lansiumdomesticum and Sandoricumkoetjape against lepidopteran larvae. Phytoparasitica, 32, 30 – 37.

7. Baskar, K., S. Kingsley, E.S. Vendan, M.G. Paulraj &Ignacimuthu, S. (2009). Antifeedant, larvicidal and pupicidal activities of Atalantiamonophylla (L) Correa against Helicoverpaarmigera Hubner (Lepidoptera: Noctuidae). Chemosphere, 75, 355-359.

8. Bouda. H., Tapondiou. L. A., Fontem, D. A. &Gumedzoe, M.Y. D. (2001). Effect of essential oils from leaves of Ageratum conyzoides, Lantana camara and Chromolaena odorata on the mortality of Sitophilus zeamais (Coleoptera: Curculionodae). Journal of Pest Science, 37(2), 103 – 109.

9. Chen, W., Isman, M. B. & Chiu, S. F. (1995). Antifeedant and growth inhibitory effects of the limonoid toosendanin and Melia toosendan extracts onthe variegated cutworm, Peridromasaucia (Lepidoptera: Noctuidae). Journal of Applied Entomology, 119, 367-370.

10. Dhadialla, S., Carlson, R. & Le, P. (1998). New insecticides with ecdysteroidal and juvenile hormone activity. Annu. Rev. Entomol. 43: 545569.

11. EI-Aswad, A. F., Abdelgaleil, S. A. M. & Nakatani, M. (2003). Feeding deterrent and growth inhibitory propterties of limnoids from Khaya senegalensis against the cotton leafworm Spodoptera littoralis. Pest. Manag. Sci., 60, 199- 203.

12. Feng R, and Isman, M. B. (1995). Selection for resistance to azadirachtin in the green peach aphid Myzuspersicae. Experientia, 51, 831-833

13. Finney, D. J. (1971). Probit Analysis. Third edition. Cambridge University Press, London, UK, pp.383.

14. Kamal, R. & Mehra, P. (1991). Efficacy of pyrethrins extracted from Dysodiatennifolius and Ageratum conyzoides against larvae of Anopheles stephensi. Pyrethrum Post, 18(2), 70–73.

15. Kranthi, K. R., Jadhav, D. R., Kranthi, S., Wanjari, R. R., Ali, R. R. & Russell, D. A. (2002). Insecticide resistance in five major insect pests of cotton in India. Crop. Prot., 21, 449-460.

16. Lange, A. B., Phillips, D. R. & Loughton, B. G. (1983). The effects of precocene II on early adult development in male locust. Journal of Insect Physiology, 29, 73- 81.

17. Larsen, A. K., Grondard, L., Couprie, J., Desoize, B.,Comoe, L., Jardillier, J. C. & Riou, J. R. (1993). The antileukaemic alkaloid fagaronine is an inhibitor of DNA topoisomeraseI and II. Biochemical Pharmacology, 46, 1403 – 1412.

18. Mochizuki A. (1993). Antifeedant activity of neem oil to rice water weevils, Lissorhoptrusoryzophilus Kuschel (Coleoptera: Curculionidae). Appl EntomolZool, 28, 254-256.

19. Moreira, M. D., Picano Marcelo, C., Barbosa, L. C. A., Guedes, R. N. C., Baros, E. C. & Campos, M. R. (2007). Compounds from Ageratum conyzoides: Isolation, Structural elucidation and insecticidal activity. Pest Management Science, 63(7), 615 – 621.

20. Onyilagha, J. C., Lazorka, J., Gruber, M. Y., Soroka, J. J. & Erlandson, M. A. (2004). Effect of flavanoides on feeding preference and development of the crucifer pest. Journal of Chemical Ecology, 30, 109- 124.

21. Padmaja, P. G. & Rao, P. J. (1999). Effect of plant oils on the fat body proteins of Helicoverpaarmigera Hubner. Indian Journal of Entomology, 61(4), 330- 336.

22. Pascual, M. J. V. & Robledo, A. (1999). Antiinsect activity of plant extracts from the wild flora in south eastern Spain. Biochemical Systematics and Ecology, 27, 1-10.

23. Saxena, R. C., Saxena, A. & Singh, C. (1994). Evaluation of growth disrupting activity of Ageratum conyzoides crude extract on Culex quinquefasciatus (Diptera: Culicidae). Journal of Environmental Biology, 15(1), 67–74.

24. Sutherland J, Baharally V & Permaul D. (2002). Use of the botanical insecticide, neem to control the small rice stinkbug Oebaluspoecilus (Dallas, 1851) (Hemiptera: Pentatomidae) in Guyana.
Entomotropica, 17, 97-101.

25. Tapondiou, A. I., Adler, C., Fontem, D. A., Bouda, H. &Reichmuthu, C. H. (2005). Bioactivities of cymol and essential oils of Cupressus sempervirens and Eucalyptus saligna against Sitophilus zeamaisMotschulsky and Triboliumconfusum du Val. J. Stored Prod. Res., 41, 91-102.

26. Ulrichs, C. H., Mews, I., Adhikary, S., Bhattacharyya, A. & Goswami, A. (2008).
Antifeedant activity and toxicity of leaf extracts from PortesiacoarctataTakeoka and their effects on the physiology of Spodoptera litura (F.). J. Pest Sci.,
18, 79-84